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MISA
METAL CASTING

STOPPING WATER POLLUTION AT ITS SOURCE

MISA

Municipal/Industrial Strategy for Abatement

MONITORING COSTS AND THEIR IMPLICATIONS FOR DIRECT DISCHARGERS IN THE ONTARIO METAL CASTING INDUSTRY

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MONITORING COSTS AND THEIR IMPLICATIONS FOR DIRECT DISCHARGERS IN THE ONTARIO METAL CASTING INDUSTRY

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ABSTRACT

Estimates of the incremental costs to Ontario's metal casting plants that are direct dischargers subject to the MISA Monitoring Regulation are derived and summarized. The Regulation applies to only 13 metal casting plants out of about 300 in Ontario. Six of the 13 firms that own these plants are private companies and the other seven are public firms.

Capital and operating costs are estimated by plant for each of the six major monitoring activities.

- sampling;
- characterization;
- routine analyses;
- toxicity testing;
- flow measurement; and
- reporting.

The capital cost estimates and some of the operating cost estimates were provided by company officials.

Incremental capital costs for the 13 metal casting plants are estimated to be approximately $535,000, and range on a per plant basis from $1,600 to $238,000.

Operating cost estimates over the 12 month period range from $9,100 to $316,000 per plant, and total approximately $884,000.

Three of the larger plants account for roughly 82% of the estimated expenditures. The remaining 10 operations account for the remaining 18% of potential costs.

The total estimated costs for the 13 plants for all six monitoring activities is approximately $1.4 million. The total cost estimate for the metal casting plants has been reduced since public review, despite the additions of companies and toxicity requirements, primarily due to cost reductions achieved by Haley Industries through physical adjustments to its infrastructure which altered the classification of one of their effluent streams from process water to storm water.

If all plants were required to monitor all effluent streams for a consistent set of parameters at the same frequency, total cost of analytical and toxicity testing for this sector

would total $1.1 million. This difference represents a cost savings of approximately $500,000 and is a measure of the cost-effectiveness of the site-specific approach adopted for this sector.

The financial impacts of the estimated monitoring costs on the metal casting plants were analyzed using historical data for the period 1982-1987.

Capital costs, when viewed in terms of average annual capital expenditures over the 1982 to 1987 period, represent between 0.001% and 3.2% of each plant's (or firm's) expenditures.

Operating costs in relation to average annual after-tax earnings, again over the same period, range from .001% to 14%. In fact, in only one plant are monitoring operating costs greater than 5% of annual average after-tax earnings.

Potential benefits to the metal casting plants required to monitor include reduction to operating costs by reducing water usage and process material losses, and goodwill gained by demonstrating to the public that the company is a good corporate citizen responding to environmental problems. In addition, the monitoring data base will be available to design cost-effective control programs aimed at the virtual elimination of toxic contaminants of their source.

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1.0 BACKGROUND AND PURPOSE OF REPORT

1.1 MISA Objectives

The MOE's Municipal-Industrial Strategy for Abatement (MISA) is intended to achieve the "virtual elimination of toxic contaminants in municipal and industrial discharges into waterways."

The MISA program consists of three broad components:

1. Development and promulgation of Regulations which specify (a) contaminant monitoring requirements, and (b) effluent limits.

2. Development of these effluent limits based on "best available technology economically achievable" (BATEA) or water quality impacts.

3. Implementation of abatement programs and enforcement activities.

Economic assessments of each component of the MISA program are also being prepared. These assessments are intended to enumerate the costs and the benefits of the various regulations and other program elements and then analyze the economic and financial implications of these costs and benefits.

The MISA program will encompass at least 200 Ontario industrial establishments which discharge contaminants directly into waterways disaggregated into nine industrial sectors:

- petroleum refining
- organic chemical manufacturing
- pulp and paper
- iron and steel
- metal mining and refining
- industrial minerals and manufacturing
- electric power generation
- inorganic chemicals
- metal castings.

The first phase of the MISA regulatory program is the promulgation of Monitoring Regulations for those plants within each of the industrial sectors which discharge waste waters directly into the natural environment.

All direct dischargers are subject to a "General" and "Sector Specific" Monitoring Regulation. The

General Regulation was promulgated in June 1988 and specifies monitoring requirements which apply to all industries. Sector specific regulations are currently being developed for each industrial sector.

This investigation is part of the economic assessment component of the MISA program. The economic rationale, purpose and elements of the economic component of the program are discussed in the report "Economic Information Needs and Assessments for Developing MISA Monitoring and Abatement Requirements" (Ontario Ministry of the Environment, March 1987).

1.2 Sector Definition

The metal casting sector includes those establishments that manufacture metallic objects by cooling molten metal in a mold or die. Within this broad definition, a variety of establishments are included which use different metals and molding techniques and produce a wide range of finished products. The sector can be subdivided into ferrous and non-ferrous casters, die casters and foundries and even further partitioned into specific metal groups and casting techniques.

A search of association memberships, government statistics and numerous other data sources identified over 300 metal casting plants active in Ontario. Further information about the metal casting industry in Canada and Ontario can be found in the Metal Casting Industry Economic Profile (Deloitte, Haskins & Sells, 1988). A survey of these 300 odd metal casting plants by the MOE Water Resources Branch showed that they differ significantly with respect to wastewater generation and disposal practices.

Of the 300 or so metal casting plants in Ontario, approximately 175 will not be subject to the MISA regulations since they do not produce industrial wastewater. About 112 of the remaining plants discharge only storm or cooling water to municipally or provincially owned sanitary sewers. These plants which discharge wastewaters to municipal and provincial sewers, will eventually be subject to monitoring and abatement requirements under the MISA Sewer Use Program (MOE, February 1988). The remaining 13 plants, that directly discharge their wastewater to streams or

lakes, are currently subject to the MISA Monitoring Regulation (Ontario Ministry of the Environment, March 1989).

1.3 Effluent Monitoring Regulation for Ontario's Metal Casting Plants

The 13 metal casting plants which are subject to the Monitoring Regulations for direct dischargers are listed in Table 1.1.

TABLE 1.1

METAL CASTING SECTOR PLANTS

OWNERSHIP	PLANT	LOCATION	NUMBER OF EMPLOYEES
Acustar Canada Inc. is a subsidiary of Acustar U.S. which is a subsidiary of Chrysler U.S.	Acustar Canada Inc. Casting Plant	Etobicoke	450
The Bowmanville Foundry Company Ltd.	Bowmanville Casting Plant	Bowmanville	62
Canada Alloy Casting Ltd.	Canada Alloy Plant	Kitchener	110
Canada Pipe Company Ltd., a wholly owned subsidiary of McWane Inc., located in Birmington, Alabama.	Canada Pipe Company Ltd. Plant	Hamilton	270
Crowe Foundry Ltd.	Crowe Foundry Ltd. Plant	Cambridge	200
Fahramet Steel Castings Indusmin Division of Falconbridge Ltd.	Fahramet Steel Castings Indusmin Division Plant	Orillia	240

OWNERSHIP	PLANT	LOCATION	NUMBER OF EMPLOYEES
Ford Motor Company of Canada Ltd., a subsidiary of Ford Motors Corporation	Ford Motor Company Windsor Casting and Engine Plant	Windsor	1,000
Franklin Electric of Canada Ltd., a subsidiary of Franklin Electric Company Inc.	Franklin Electric of Canada Ltd. Casting Plant	Strathroy	200
General Motors of Canada Limited, a subsidiary of General Motors Corporation	G.M. Canada St. Catherines Metal Casting and Engine Plant	St. Catherines	2,500
Haley Industries Limited	Haley Casting Plant	Haley Station	413
Magalloy Ltd.	Magalloy Limited Casting Plant	Stratford	38
Richmond Die Casting Ltd., owned by Meridian Technologies Inc.	Richmond Die Casting Plant	Cornwall	125
Western Foundry Company Ltd.	Western Foundry Casting Plant	Wingham	300

The 13 metal casting companies subject to the Regulation will be required to submit an "Initial Report" under the reporting requirements within three months and seven days following promulgation of the Regulation. The primary requirements of the Regulation come into force five months after its promulgation. The five month implementation period is intended to provide sufficient time to allow the plants to purchase and install equipment, negotiate contracts with laboratories, set up their monitoring programs and train personnel.

As noted, monitoring requirements for the metal casting plants are specified in two regulations:

1. "Effluent Monitoring - General" which specifies common sampling, analysis, toxicity testing, flow measurement, recording and reporting protocols and procedures for all MISA sectors; and

2. "Effluent Monitoring - Metal Casting Sector" which defines monitoring requirements specific to the metal casting.

The "Effluent Monitoring - General" regulation will continue in force for each MISA sector.

1.4 Purpose and Objectives of Present Report

The monitoring requirements have been developed during negotiations with industry representatives through a Joint Technical Committee (JTC). Cost-effectiveness has been considered in arriving at the agreed-to protocols and requirements.

This report is intended to present estimates of the potential incremental costs to the 13 metal casting plants in Ontario of implementing the sector specific and general monitoring regulations. The economic effects and financial implications of these costs on the subject firms will be analyzed where data are available.

The current Monitoring Regulation has gone through several drafts, resulting in a Regulation that satisfies government objectives, industry concerns and public representative suggestions. Evidence of the cost-effectiveness of the proposed requirements is revealed by comparing the costs associated with the proposed plant and pipe-specific requirements with the potential costs incurred under an alternative set of requirements. These comparative estimates show the extent to which these Regulations are cost-effective.

1.5 Cost Estimation Methods

Incremental costs of monitoring consist of recurring operating costs and one time capital and installation costs. In this report, capital and operating costs have been estimated for each monitoring function at each of the 13 plants subject to the Regulation.

Steps involved in cost estimation include the determination of the activities and items that are required to implement each monitoring function, and the use of simplifying assumptions where necessary (see Appendix C).

The costs of chemical analyses and biotoxicity tests were estimated by assuming that all analytical testing will be performed by commercial laboratories. Even when plants have the ability to conduct analyses on-site, this assumption was made in order to obtain comparable cost estimates for each of the plants. Consequently, in cases where a firm intends to do some or all of the testing in house, the analytical costs may be overestimated.

Single-valued or point estimates are presented, but should be treated with caution. Inputs required for different types of monitoring functions are often uncertain and there is some flexibility as to how individual plants may implement some of the monitoring requirements. Moreover, in the case of this sector, some of the plants are investigating combining effluent streams to reduce the number of sample points, switching from water cooling systems to air cooling, and connecting their discharges to municipal sewers so as to avoid or reduce monitoring requirements and costs at this time.

Cost-effectiveness of the monitoring requirements has been examined by comparing the costs associated with the site and pipe specific requirements to potential costs incurred when plants are required to monitor all effluent streams for a consistent set of parameters at the same frequency.

All cost estimates are expressed in 1989 dollars.

Relevant cost tables, assumptions, and general factors used to calculate cost estimates can be found in Appendices A-E.

1.6 Pre-Regulation Consultation and Meetings

Industry representatives from the metal casting sector spent time at meetings and review committees in order to participate in the development of the regulations.

These meetings included participation on the Metal Casting Sector Joint Technical Committee (JTC) and its Analytical and Regulation Subcommittees. In addition, metal casting company staff devoted time

to provide technical and cost information to Ministry of the Environment staff. According to company officials, total time spent for Pre-Regulation assessments, consultation and meetings amounted to 883 person-hours.

Participation in these meetings may represent an opportunity cost in terms of time spent away from regular business. According to industry representatives, personnel involved in these meetings earn between $25 and $100 per hour. Valued in terms of these gross salary dollars, the cost of Pre-Regulation consultation and meetings would range from $500 to $11,000 per plant, not including transportation. In addition, Acustar, Ford, General Motors and Haley contracted consultants to conduct Pre-Regulation monitoring. The total amount of money spent on these consultants was reported to have been $107,000. The estimated cost of all monitoring, meetings and consultation for these 13 plants totalled $143,925 as noted in Appendix B.

However, because these employees involved i Pre-Regulation Monitoring are salaried (i.e., they are paid whether they work on MISA or on other assigned duties), the cost may be some amount less than these gross values. This will be particularly true where dealing with environmental regulations is part of the employees regular duties. Although for some plants using staff employed in a production related capacity, the opportunity cost would not only include salaries and benefits, but an expected rate of return on the company's investment in labour.

The Pre-Regulation costs have likely reduced some of the cost estimates for collecting information for the initial report. However, since these present no future costs to the firms directly, they have been treated as sunk costs in the following analyses.

In addition to the time spent by company officials, representatives of three foundry and die casting associations have contributed time to this effort. The associations that have contributed to the development of the Regulation are:

(i) The Canadian Foundry Association (CFA);
(ii) The Ontario Chapter of the American Foundrymens Society (AFS); and
(iii) The Canadian Die Casters Association (CDCA).

The CFA and CDCA are business associations which represent member firms, however not all of the firms in the sector are members. The AFS is a technical society. For the purpose of this analysis, association costs have been assumed as part of their normal activities.

2.0 MONITORING COST ESTIMATES

2.1 Regulation Requirements

The General Effluent Monitoring Regulation - General specifies requirements for six major monitoring activities which each wastewater discharger must implement to various degrees and levels of effort.

1. Sampling;
2. Characterization;
3. Routine analyses;
4. Toxicity testing;
5. Flow measurement; and
6. Reporting.

Five types of effluent streams or "sampling points" are defined in the specific Regulation for the metal casting sector.

1. Process effluent after final treatment;
2. Cooling water;
3. Storm water run-off;
4. Combined process effluent; and
5. Cooling water streams with a potential for contamination.

The Monitoring schedules for the metal casting plants, which can be found in the sector- specific Regulation, differ according to the type of effluent stream and the manufacturing processes found at each plant. The number and types of effluent streams have been identified in Table 2.1.

TABLE 2.1

NUMBER AND TYPE OF EFFLUENT STREAMS BY PLANT

	Process Effluent	Cooling Water	Storm Water	Combined Process Effluent	Cooling Water With Potential for Contamination	Total
Acustar		1				1
Bowmanville		1				1
Canada Alloy		1				1
Canada Pipe		3		1		4
Crowe				1		1
Farhamet					1	1
Ford	1			1		2
Franklin					1	1
General Motors	1			1		2
Haley	1		1			2
Magalloy		1				1
Richmond		1				1
Western	—	2	—	—	—	2
TOTALS	3	10	1	4	2	20

2.2 Sampling Requirements

Sampling protocols and specifications are defined in Section 3 of the "Effluent Monitoring - General" Regulation.

This function involves taking water samples from designated sampling points, transporting the samples to a central facility in the plant, storing them under refrigeration where necessary and then transporting the samples to lab facilities within a prescribed time period. Samples will be required for characterization, routine analyses and for toxicity tests.

Operating costs of sampling may consist of the following components:

- operating of vehicle on the plant premises;
- transportation of samples to laboratories;
- operating and maintenance of automatic sampling devices; and
- personnel required either for collection of manual samples or from automatic sampling devices.

Wage rates cited for relevant personnel to collect samples ranged from $11.00 to $30.00 per hour. Consequently, personnel cost estimates for manual sampling or collection of automatic samples for the plants range from $400 to $33,000 (Ford) per plant.

Another component of the operating costs is the transportation of the samples to the laboratories. Only Ford and General Motors indicate that company personnel would transport samples to the lab. The other companies have estimated the cost of transportation assuming the use of a courier. It is estimated that it would cost about $1,000 per sampling point over the 12 month period of the Regulation for those companies failing to provide their own estimates (see Appendix D). This estimate is based on courier transportation costs submitted by other metal casting plants. Firms which provided transportation cost estimates ranged from $300 to $3,600. Ford and General Motors stated that transport would cost them $22,000 and $19,000 respectively because company employees would deliver them. These costs can be reduced by contracting a laboratory to pick-up the samples, which can be coordinated with current sample deliveries.

Another operating cost element is maintenance and calibration of sampling equipment. These costs are associated with those plants using automatic samplers. Estimates for this cost element range from $1,600 for General Motors and Haley to $6,000 for Ford. However, Ford's estimate also includes the maintenance and calibration of flow measurement equipment.

In addition to the foregoing operating cost elements, General Motor and Haley included $1,000 each for contingencies.

In total, operating costs for sampling range from $1,120 to $60,000 per plant per year, with a total estimate of $144,170 for the 13 plants. The range of costs per plant reflects the number and frequency of the effluent streams that must be sampled at each plant.

Capital expenditures for sampling would include equipment, installation and construction costs.

Equipment that may be required include automatic samplers, refrigeration units for the automatic samplers and for storage, insulated enclosures for automatic samplers and transmission systems.

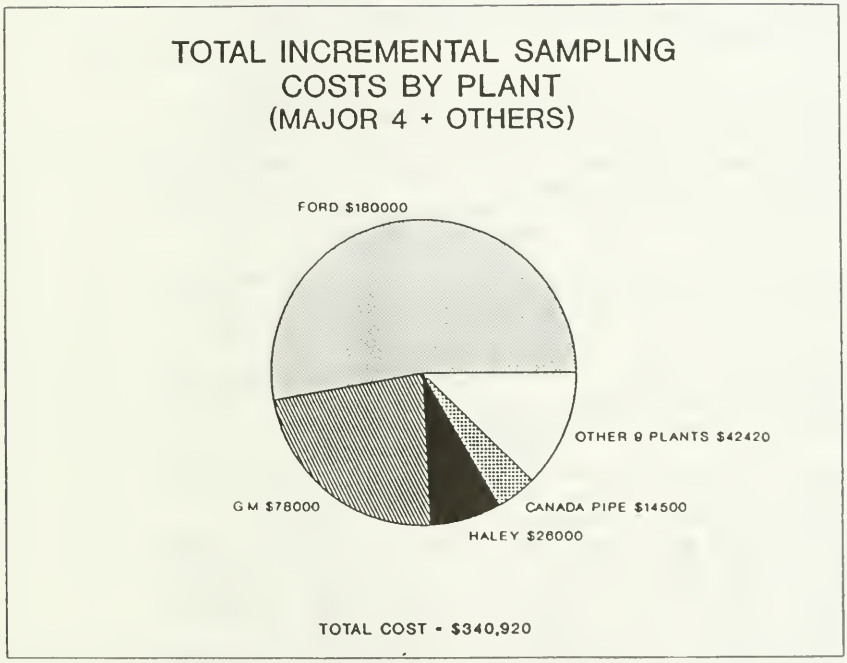
The cost of refrigeration units for automatic samplers are usually included in the costs of the automatic samplers.

For the purpose of this analysis, it was assumed that all plants should include the cost of a storage refrigerator. Therefore, $1,500 was applied to those companies that did not report a storage refrigerator in their cost estimates.

Installation costs of a sampling facility, which includes temperature recorders, electrical supply, signal cables and construction are sensitive to site specific circumstance. Installation costs can amount to as much as two times the equipment cost.

Capital cost estimates were supplied by each plant and reviewed by MOE technical staff. As shown in Table 2.4, the costs range from $1,600 to $120,000 (Ford) per plant. This wide range is due primarily to the number of effluent outlets at each plant as well as the number of devices which plants intend to install, and costs associated with installing the devices.

FIGURE 2.1


TOTAL INCREMENTAL SAMPLING
COSTS BY PLANT
(MAJOR 4 + OTHERS)
FORD $180000
OTHER 9 PLANTS $42420
CANADA PIPE $14500
HALEY $26000
G M $78000
TOTAL COST = $340,920

The point estimate of the total capital expenditure for sampling at the 13 plants is $196,750.

Based on the foregoing discussion, the total operating and capital cost for sampling activities are estimated to be $340,920 for the sector. The breakdown of total incremental sampling costs per plant is shown in Figure 2.1.

2.3 Flow Measurement

Flow measurement is required to calculate total loadings of contaminants discharged to the environment.

Operating cost estimates for flow measurement include manual calculation of flow, replacement of charts and calibration and maintenance of flow measurement devices. Operating cost estimates from the casting plants ranged from $0 to $10,000 (Ford) per plant. The total estimated operating cost to the 13 plants for flow measurement is $25,610.

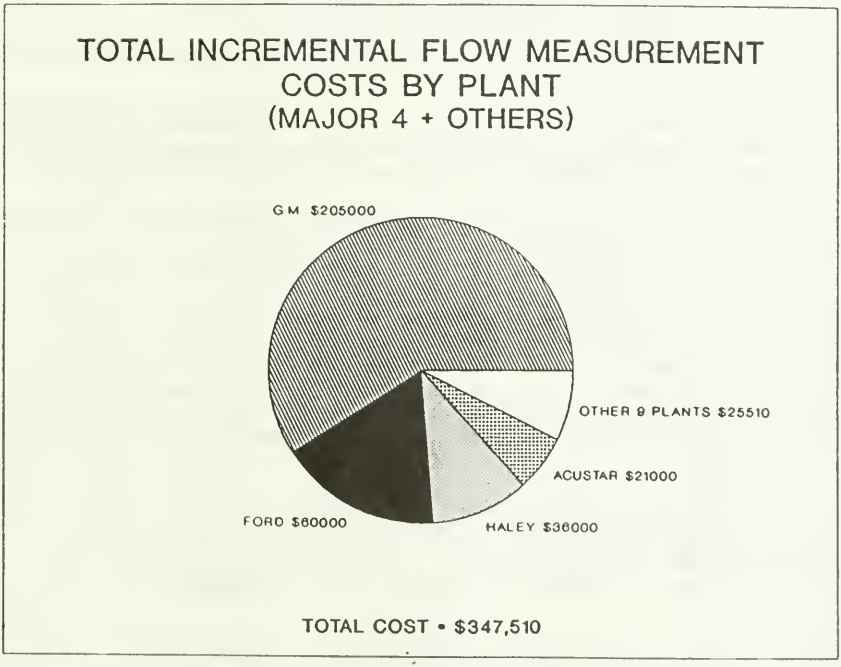
Primary and/or secondary flow measurement devices are required to achieve the accuracy specified for the process and final effluent sampling points.

Installation costs will vary among plants due to site-specific characteristics such as the volume of effluent flow, location of pipes, etc.

Capital costs of flow measurement facilities were supplied by each plant and reviewed by MOE technical staff. Capital costs for flow measurement equipment and installation range from $0 to $200,000 (General Motors) per plant. This large difference is due to the type and number of devices which the companies report they intend to install and the differences in costs for installation and preparatory site work. The total point estimate of capital costs for flow measurement for the 13 metal casting plants is $321,900. The distribution of these estimates is shown in Table 2.4.

The total estimate for both capital and operating expenditures is $347,510. The distribution of total incremental flow measurement costs among the various casting plants is illustrated below in Figure 2.2

FIGURE 2.2



2.4 Analytical Testing

As noted earlier, it is assumed that characterization, toxicity testing, and routine analyses will be performed by a commercial laboratory, even though some plants have the ability to conduct many of the analyses on-site. This has been done in order to obtain comparable cost estimates for each of the plants.

Analytical testing, includes characterization, routine and toxicity testing, which together represent the largest component of the incremental operating costs associated with monitoring, amounting to 73.6% of the total operating cost for these 13 plants.

The cost of analytical testing was estimated for the 12 month period of the regulations and is based on laboratory test prices listed in Table 2.3.

Because test prices can vary with volume discounts, average prices cited in Table 2.2 were used to calculate the costs of analytical testing. The 27 test groups include about 150 individual chemicals. In addition, open and elemental scans must be carried out on a certain set of samples. Some test groups, such as Groups 4a and 4b, currently have one common price, even if only one compound within them requires testing. This feature may cause an overestimation of laboratory testing costs.

Prices of laboratory tests include quality assurance/quality control (QA/QC) samples and the preparation of required reports from the lab to the plant, but do not include transport from plants to labs.

Some effluent streams which are not continuous are to be tested on an "event" basis. Cost estimates for "event" tested streams are based on the frequencies reported by the individual plants.

2.5 Routine Analyses

Routine analyses involve testing samples for individual chemical compounds taken at four frequency levels - daily, three times per week, weekly, monthly, plus on an event basis.

TABLE 2.2

LABORATORY TEST PRICES FOR ANALYTICAL TEST GROUPS

No.	Analytical Test Group	Price ($)			
		Low	Median	Average	High
1.	Chemical Oxygen Demand	14.00	26.00	29.78	70.00
2.	Cyanide	10.00	32.50	36.10	100.00
3.	Hydrogen Ion (pH)	1.30	5.75	6.84	30.00
4a.	Ammonia and Ammonium Nitrogen plus Total Kjeldahl Nitrogen.				
4b.	Nitrate and Nitrite	40.00	55.60	86.99	230.00
5.	Organic Carbon (DOC)	10.00	50.00	57.03	130.00
6.	Total Phosphorus	8.75	20.00	25.12	120.00
7.	Conductivity	2.50	8.00	9.44	45.50
8.	Total Suspended Solids (TSS) Volatile Suspended Solids (VSS)	5.00	13.00	14.87	45.50
9.	Metals (13 metals)	10.00	-	84.10	491.40
10.	Hydrides (Arsenic only)	7.00	20.00	23.33	80.00
11.	Chromium (Hexavalent)	5.00	19.00	20.47	53.30
12.	Mercury	7.00	25.75	25.77	85.00
13.	Total Alkyl Lead	39.00	93.75	172.00	420.00
14.	Phenolics (4AAP)	19.50	35.00	42.93	130.00
15.	Sulphide	-	-	30.00	-
16.	Volatiles, Halogenated	83.00	226.25	239.90	1,020.50
17.	Volatiles, Non-Halogenated	85.00	200.00	176.81	435.50
18.	Volatiles, Water Soluble	50.00	195.00	126.50	325.00

TABLE 2.2 (Continued)

LABORATORY TEST PRICES FOR ANALYTICAL TEST GROUPS

No.	Analytical Test Group	Price ($)			
		Low	Median	Average	High
19	Extractables, Base Neutral	100.00	355.00	427.49	1,560.00
20.	Extractables, Acid (Phenolics)	65.00	260.00	245.68	780.00
21.	Extractables, Phenoxy Acid Herbicides	85.00	185.00	188.09	360.00
22.	Extractables, Organo-chlorine Pesticides	100.00	205.00	270.14	975.00
23.	Extractables, Neutral Chlorinated	105.00	200.00	232.04	900.00
24.	PCDDs & PCDFs	325.00	1,000.00	1,228.27	2,600.00
25.	Oil & Grease	15.00	30.00	36.00	125.00
26.	Fatty Acids & Resins	15.00	143.75	133.18	350.00
27.	PCBs (Total)	40.00	105.00	103.90	240.00
28. and 29.	Open Characterizations (Note 1)	-	-	850.00	-
	Supplemental Test Groups for the Metal Casting Sector				
	MC1: Metals	Included in Total Metals			
	MC2: Fluoride	-	-	26.50	-

NOTE 1: Average Open Characterization costs are calculated at $850 per test. This is calculated as $550 for ATG 28 (Volatiles and Extractables) plus $300 for ATG 29 (Elemental).

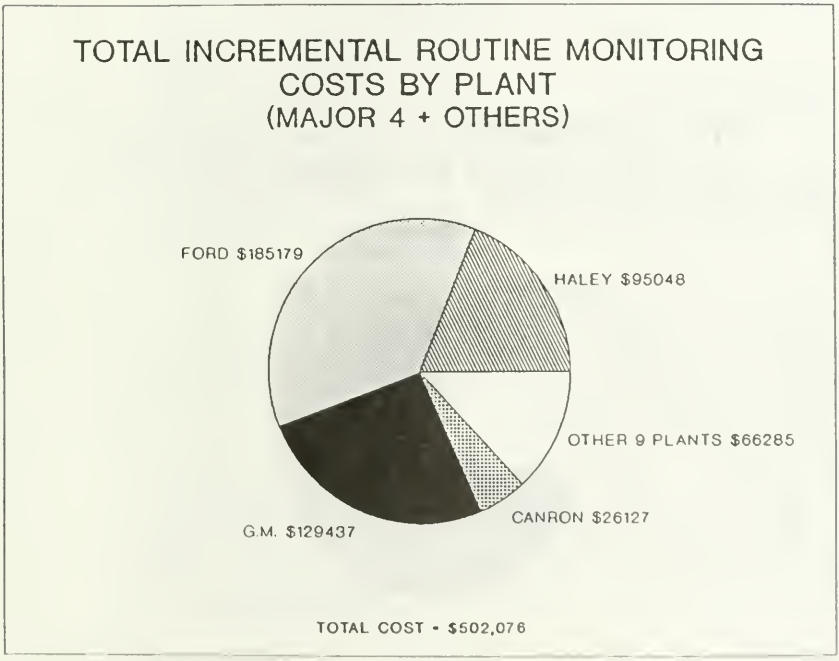
Source: Based on data derived from M.M. Dillon, Inventory and Critical Review of Laboratory Resources, Toronto. Prepared for the Ontario Ministry of the Environment, 1988.

Figure 2.3 below shows the cost of routine analyses per plant using average laboratory test prices.

The annual cost of routine analyses ranges from $4,724 for Franklin to $185,179 for Ford (see Table 2.4).

The estimated cost of routine analyses using the average prices totalled $537,890. This total excludes transportation. Over 83% of the total cost for routine analyses is expected to be borne by three plants.

FIGURE 2.3



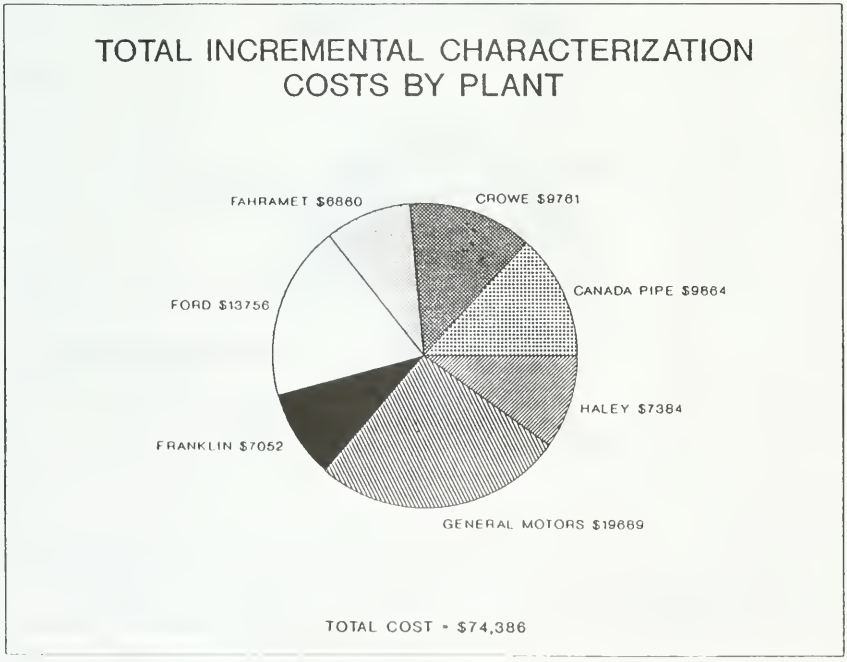
2.6 Characterization and Open Characterization Analyses

Characterization and open characterization analyses are procedures which identify the presence or absence of specified chemical species or analytical test groups in an effluent stream.

Figure 2.4 summarizes annual total characterization costs using average prices, excluding transportation, per plant. Total characterization costs, as shown in Table 2.4, ranged from $0 to $19,689 (G.M.) per plant using average laboratory testing prices. Six of the 13 casting plants have no characterization requirements.

Total annual cost of characterization for the metal casting sector amounts to $74,386.

FIGURE 2.4



These cost estimates do not include Pre-Regulation characterization analyses. Pre-Regulation monitoring is not specifically required by the Regulations, although this work was carried out in anticipation of the MISA monitoring activities.

2.7 Toxicity Testing

Biological toxicity testing involves the use of the static 96-hour rainbow trout toxicity test and a 48-hour Daphnia magna (a small invertebrate crustacean) mortality (acute lethality toxicity) test.

Process effluent and/or combined effluents are to be tested monthly with trout toxicity and Daphnia Magna. Toxicity testing costs are based on the following prices for a full dilution series:

Trout: $360 per full dilution test
Daphnia: $240 per test

These prices do not include costs of collecting samples or transport to a laboratory.

Using these prices, the maximum total annual cost for toxicity testing is $38,400 for the 13 plants. The estimates per plant for each test are shown in Figure 2.5 and Table 2.3.

If three successive, full dilution LC-50 rainbow trout tests prove non-toxic, subsequent rainbow trout tests may use the single concentration test on full strength effluent only. If any subsequent full strength test shows the stream to be toxic, full dilution LC 50 tests shall be required until the criterium is met. An effluent is defined as non-toxic if that effluent kills 20% or less of the rainbow trout at any dilution. Table 2.3 shows that under this minimum cost scenario, toxicity costs could be reduced to $35,955. Figure 2.5 shows a total savings of $3,645 if the minimum cost scenario for toxicity testing is applied.

FIGURE 2.5

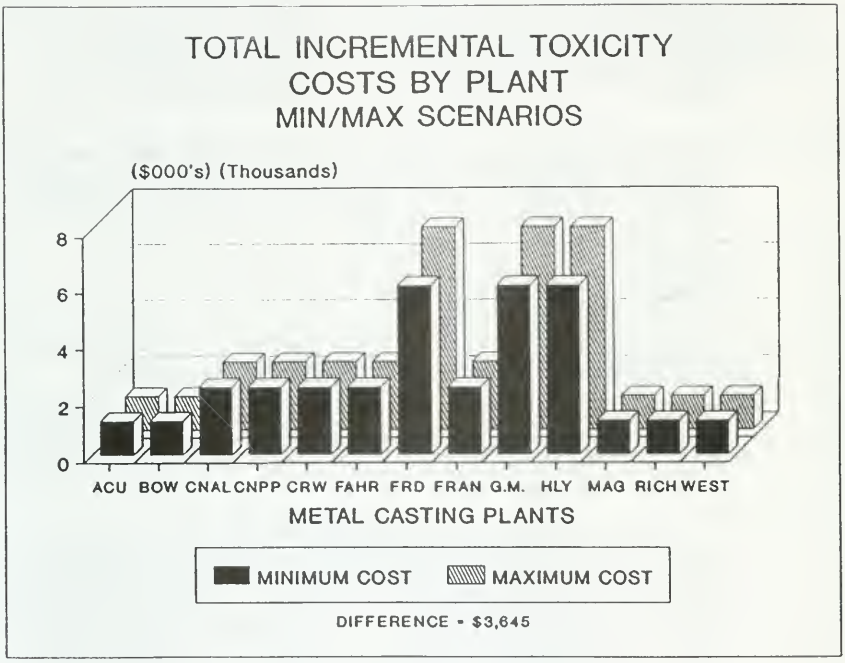

TOTAL INCREMENTAL TOXICITY
COSTS BY PLANT
MIN/MAX SCENARIOS
($000's) (Thousands)
8
6
4
2
0
ACU BOW CNAL CNPP CRW FAHR FRD FRAN G.M. HLY MAG RICH WEST
METAL CASTING PLANTS
MINIMUM COST
MAXIMUM COST
DIFFERENCE = $3,645

TABLE 2.3

Metal Casting Direct Dischargers
Toxicity Testing Costs

Company/Plant	# of Sampling Points Requiring Toxicity Testing	# of Tests		Costs for Toxicity Testing				
				Trout		Daphnia	Total	
		Trout	Daph	Max	Min		Max	Min
Acustar Canada Inc-Etobicoke	1	2	2	$720	$720	$480	$1,200	$1,200
Bowmanville Foundry Co. Ltd.-Bowmanville	1	2	2	$720	$720	$480	$1,200	$1,200
Canada Alloy Castings Ltd.-Kitchener	1	4	4	$1,440	$1,440	$960	$2,400	$2,400
Canada Pipe Company Ltd.-Hamilton	1	4	4	$1,440	$1,440	$960	$2,400	$2,400
Crowe Foundry Ltd.-Cambridge	1	4	4	$1,440	$1,440	$960	$2,400	$2,400
Fahramet Steel Castings, Indusmin Division of Falconbridge Ltd.-Orillia	1	4	4	$1,440	$1,440	$960	$2,400	$2,400
Ford Motor Company of Canada Ltd.-Windsor	1	12	12	$4,320	$3,105	$2,880	$7,200	$5,985
Franklin Electric of Canada Ltd.-Strathroy	1	4	4	$1,440	$1,440	$960	$2,400	$2,400
General Motors of Canada Limited -St. Catharines	1	12	12	$4,320	$3,105	$2,880	$7,200	$5,985
Haley Industries Limited- Haley	1	12	12	$4,320	$3,105	$2,880	$7,200	$5,985
Magalloy Ltd.- Stratford	1	2	2	$720	$720	$480	$1,200	$1,200
Richmond Die Casting Ltd.-Cornwall	1	2	2	$720	$720	$480	$1,200	$1,200
Western Foundry Company Limited -Wingham	1	2	2	$720	$720	$480	$1,200	$1,200
Total	13	66	66	$23,760	$20,115	$15,840	$39,600	$35,955

Notes:

Cost per Test	
Trout:	$360
Pass/Fail	$225
Daphnia:	$240

Max - Assumes that three successive trout tests prove toxic, requiring continued use in remaining tests

Min - Assumes that three successive trout tests prove non-toxic, allowing for the use of the less expensive pass/fail testing for the remaining testing periods

2.8 Reporting

Reporting consists of two components: an "initial report" and "normal" daily/thrice weekly/weekly/ monthly and quarterly reporting analytical and toxicity test data to management and to the Ontario Ministry of the Environment.

Initial Report

A detailed Initial Report must be prepared and submitted to the Regional Director of the Ministry within three months and seven days following promulgation of the Regulation. This report is intended to provide the Ministry with a clear understanding of plant processes and the procedures each plant will follow in carrying out the requirements of this Regulation. The Initial Report details the plant layout, flow charts of waste streams, analytical methods used and other data. Cost estimates for preparing Initial Reports were submitted by each firm. As shown in Table 2.4, they range from $120 for the Fahramet plant to $20,000 for the Ford plant. The total estimated cost of the initial report preparation for the 13 casting plants is $28,695. The actual costs to Ford might be lower because much of the required information had already been collected during the Pre-Regulation Monitoring period.

Normal Report

Monitoring data will have to be assembled, recorded, stored, and reported to company management and to the Ministry of the Environment.

Data storage and manipulation may require an AT personal computer together with compatible peripherals and software, plus personnel dedicated to perform report generation functions. The reported wage rates for data entry personnel range from $10 to $30/hour.

Operating cost estimates for reporting totalled $34,830 and ranged from $210 for Magalloy to $20,000 for Ford. The capital costs totalled $16,250 and ranged from $0 to $10,000 for Ford. The distribution of these costs among the plants are presented in Table 2.4.

Total capital and operating cost estimates for reporting, as supplied by individual plants, range from $210 up to $30,000, totalling $51,080 for the metal casting sector (See Table 2.4).

These wide differences are due to a number of reasons:

- the number of parameters to be tested varies greatly among plants;
- the number of sample points also varies among metal casting plants; and
- some plants already have computers for data storage and manipulation.

2.9 Analytical Testing of Intake Water

Another potential sampling point is intake water. The General and Metal Casting Monitoring Regulations do NOT specify monitoring requirements for intake water. However, plants which obtain water from large surface water sources which in turn receive the wastewater discharges of other municipalities and industrial plants have an incentive to sample their intake water. Data on intake water quality would permit the firms to determine how much of a contaminant is generated by the plant and how much was already contained in the wastewater.

General Motors and Richmond Die Casting Ltd. have included intake water monitoring in their sampling cost estimates. Therefore, the estimated cost of the Regulation requirements are actually overstated.

2.10 Total Estimated Costs of the MISA Metal Casting Sector Monitoring Requirements

The diversity of the plants, in size (Magalloy Stratford - 38 employees to General Motors, St. Catharines - 2,500 employees), water usage (Crowe - 50-100m^3/day to General Motors - 130,000m^3/day), and types of effluent streams results in a wide range of incremental costs, since the monitoring requirements are of a site-specific nature.

Table 2.4 presents a summary of the estimates of operating and capital costs for each monitoring function at each plant. Total capital costs for the plants range from $1,600 to $238,000 (General Motors) for a total point estimate of $535,075. Based on average prices for laboratory tests, reported in Table 2.2, total annual operating costs

TABLE 2.4

TOTAL COSTS TO COMPANIES ASSOCIATED WITH MONITORING REGULATION

Monitoring Activities	Total	Acustar	Bowmanville	Can.Alloy	Cn.Pipe	Crowe	Fahramet	Ford	Franklin	G.M.	Haley	Magalloy	Richmond	Western
Sampling:														
-Operating	$144,170	$3,560	$1,650	$1,540	$12,700	$2,800	$1,120	$60,000	$1,400	$40,000	$14,000	$1,440	$2,030	$1,930
-Capital	$196,750	$2,500	$1,600	$1,700	$1,800	$10,500	$1,600	$120,000	$2,100	$38,000	$12,000	$1,600	$1,750	$1,600
Total Sampling	$340,920	$6,060	$3,250	$3,240	$14,500	$13,300	$2,720	$180,000	$3,500	$78,000	$26,000	$3,040	$3,780	$3,530
Flow Measurement														
-Operating	$25,610	$1,000	$300	$30	$1,900	$2,500	$0	$10,000	$150	$5,000	$4,000	$120	$250	$360
-Capital	$321,900	$20,000	$0	$0	$10,000	$4,700	$5,000	$50,000	$200	$200,000	$32,000	$0	$0	$0
Total Flow Measurement	$347,510	$21,000	$300	$30	$11,900	$7,200	$5,000	$60,000	$350	$205,000	$36,000	$120	$250	$360
Initial Report														
-Operating	$28,520	$480	$800	$290	$500	$560	$120	$20,000	$200	$1,000	$4,000	$320	$125	$125
-Capital	$175	$0	$0	$0	$0	$175	$0	$0	$0	$0	$0	$0	$0	$0
Total Initial Report	$28,695	$480	$800	$290	$500	$735	$120	$20,000	$200	$1,000	$4,000	$320	$125	$125
Reporting														
-Operating	$34,830	$1,060	$350	$450	$860	$1,500	$400	$20,000	$450	$3,000	$6,000	$210	$290	$270
-Capital	$16,250	$0	$0	$0	$0	$250	$0	$10,000	$0	$0	$6,000	$0	$0	$0
Total Reporting	$51,080	$1,060	$350	$450	$860	$1,750	$400	$30,000	$450	$3,000	$12,000	$210	$290	$270
Sub-Total	$768,205	$28,600	$4,700	$4,010	$27,760	$22,985	$8,240	$290,000	$4,500	$287,000	$78,000	$3,690	$4,435	$4,285
Total Routine Monitoring	$537,890	$6,289	$5,655	$5,557	$26,127	$10,402	$5,557	$185,179	$4,724	$142,645	$117,654	$5,655	$10,500	$11,946
Total Characterization	$50,586	$0	$0	$0	$6,464	$6,361	$6,880	$6,956	$7,052	$12,889	$3,984	$0	$0	$0
Total Open Characterization	$23,800	$0	$0	$0	$3,400	$3,400	$0	$6,800	$0	$6,800	$3,400	$0	$0	$0
Total Toxicity	$38,400	$1,200	$1,200	$1,200	$2,400	$2,400	$2,400	$7,200	$2,400	$7,200	$7,200	$1,200	$1,200	$1,200
Total Cost to Plants For Monitoring Regulation	$1,418,881	$36,089	$11,555	$10,767	$66,151	$45,548	$23,077	$496,135	$18,676	$456,534	$210,238	$10,545	$16,135	$17,431
Total Operating Cost	$883,806	$13,589	$9,955	$9,067	$54,351	$29,923	$16,477	$316,135	$16,376	$218,534	$160,238	$8,945	$14,385	$15,831
Total Capital Costs	$535,075	$22,500	$1,600	$1,700	$11,800	$15,625	$6,600	$180,000	$2,300	$238,000	$50,000	$1,600	$1,750	$1,600

for the plants range from $8,945 (Magalloy) to $316,135 (Ford). The point estimate of the operating cost totals $883,806 for the 13 plants. Appendix A provides a summary of the estimated capital and operating costs by plant.

The total estimated incremental cost of the MISA monitoring requirements per plant for the 13 metal casting plants ranges from $10,545 (Magalloy) to $496,135 (Ford). The total estimated monitoring costs to the 13 metal casting plants is $1,418,881.

Figure 2.6 below provides a breakdown of the total incremental capital and operating costs by monitoring activity. The figure shows that the largest expense for the casting plants as a whole will be the routine analyses, estimated to be approximately $537,890. The flow measurement and sampling costs are the next two largest expenses accounting for approximately $347,510 and $340,920 respectively.

FIGURE 2.6

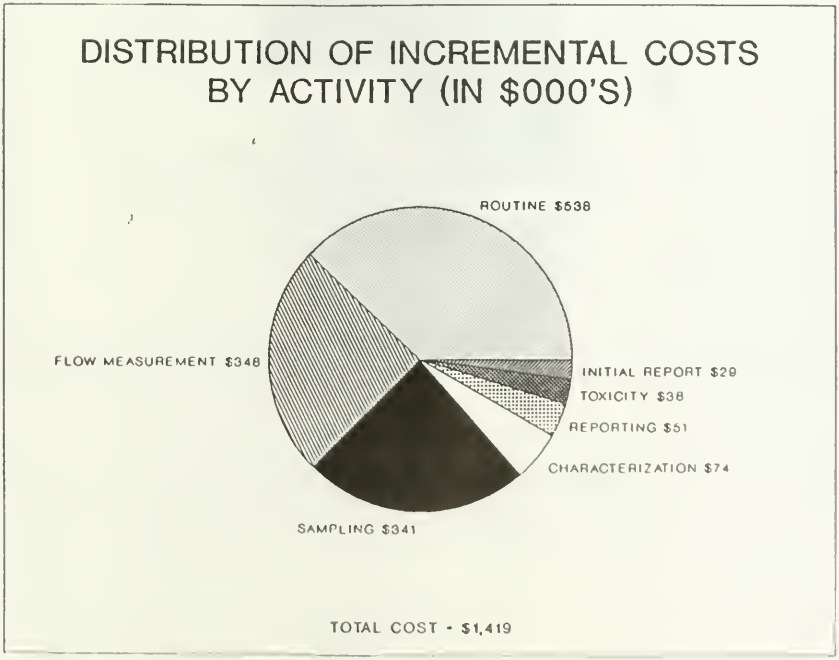
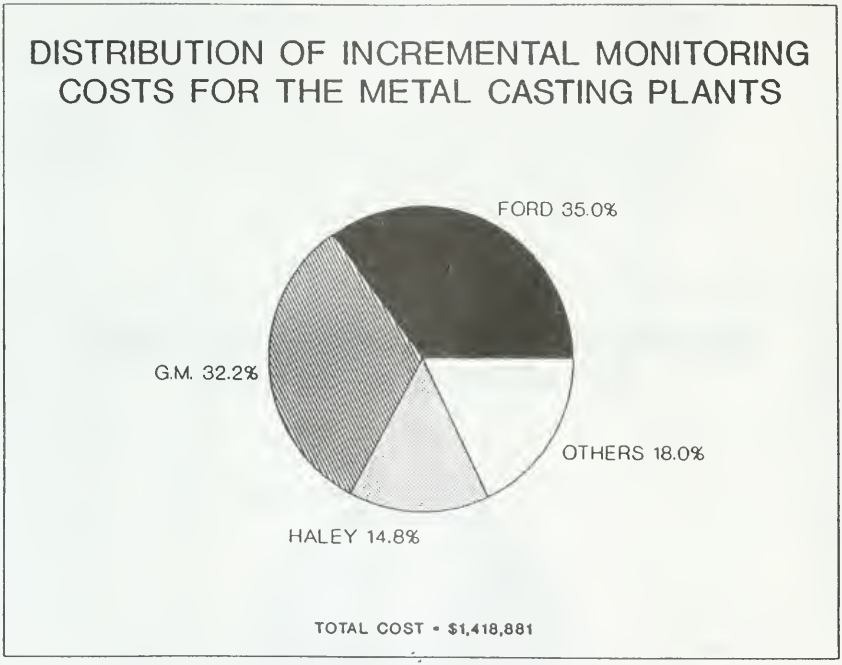


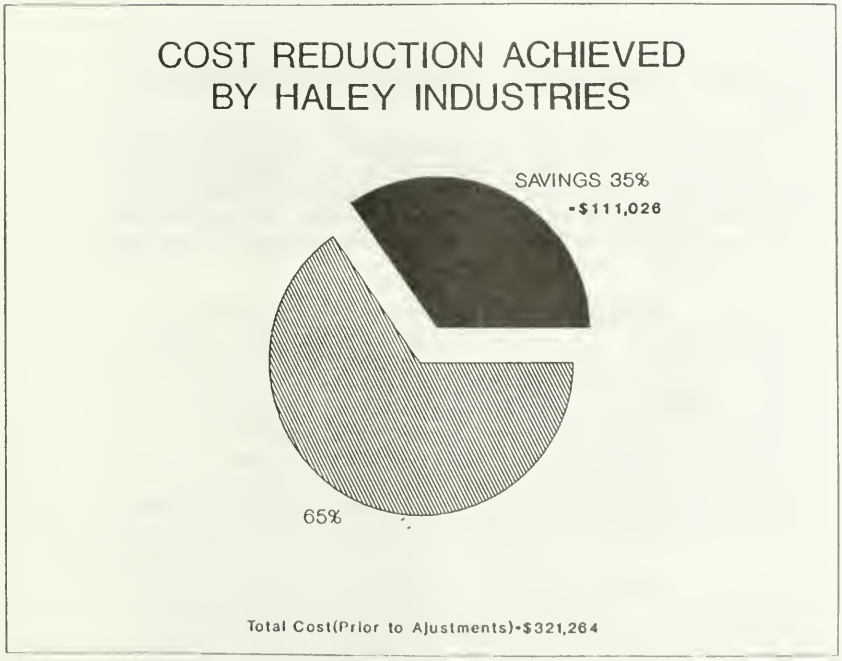
Figure 2.7 below shows the distribution of incremental monitoring costs for the metal casting plants. Three of the larger firms, (Ford, General Motors and Haley), will account for roughly 82% of all potential expenditures. The remaining nine smaller operations account for 18% of estimated monitoring costs.

FIGURE 2.7



The cost estimates have been based on the current Regulation requirements and plant discharges. However, plants have identified opportunities to reduce their costs by modifications to their processes or discharge infrastructure. For example, Haley Industries reduced its monitoring requirements, and therefore the cost of the Regulation, through physical adjustments to its infrastructure which altered the classification of one of its effluent streams from process water to storm water. As shown in the Figure 2.8, the savings to Haley is estimated to be $111,026 (see Appendix E) or 35% of its estimated total cost, prior to the adjustments, of $321,264.

FIGURE 2.8



Magalloy had notified the Ontario Ministry of the Environment of its intention to recirculate its cooling water, thereby eliminating its effluent stream. The preliminary estimated cost was approximately $6,000, which is lower than the $10,545 estimated cost of complying with the Regulation. However, since Magalloy has not as yet eliminated its direct discharge it will be included in the Regulation.

A.H. Tallman has been deleted from the Monitoring Regulation since the company is now discharging to a sanitary sewer and will be subject to the requirements of the MISA Sewer Use Control Program.

It is possible that other companies will find further cost reductions as they evaluate their alternatives.

2.11 Alternative Estimates of Analytical and Toxicity Costs

The Metal Casting Sector Regulation specifies pipe-specific testing requirements. If, however, a pipe-specific approach was not adopted and plants were required to monitor all effluent streams for the same parameters at the same frequency, the cost of monitoring would increase.

The metal casting sector monitoring requirements were developed in recognition of the fact that water usage, particularly for cooling purposes, differs significantly from most other sectors. Monitoring requirements used in other sector regulations for cooling water, i.e. quarterly toxicity testing and characterization, were not considered necessary. If the monitoring requirements used in other sectors were applied, the cost burdens would be greater.

Analytical and toxicity costs were estimated for an "alternative" scenario, in which all plants are subject to the same generic testing schedules. This was done in order to illustrate the cost effectiveness of having pipe-specific requirements. The following assumptions were used to generate this "equitable" scenario.

1. Same parameters are to be tested at same frequency.

2. Cooling water effluent streams containing small quantities of process effluent would be subjected to process effluent stream monitoring requirements.

3. Cooling water effluent streams would be subjected to quarterly characterization and toxicity testing.

4. The estimates are based on average laboratory prices as shown in Table 2.2.

The implications of this scenario for other monitoring functions, such as sampling, flow measurement and reporting were not calculated because it is expected that these costs would change little under the new scenario. The largest differences would occur in the analytical and toxicity analyses which are listed below.

The "alternative" scenario resulted in analytical and toxicity costs ranging from $14,840 to $219,344 per plant. This scenario also resulted in a total estimated analytical and toxicity cost of $1,150,288 for the direct dischargers in the metal casting sector. The estimated costs for the "equitable" scenario would represent a 77% increase over the $651,070 total cost of the proposed regulation for these activities.

Table 2.5 and Figure 2.9 below illustrate that the pipe-specific requirements under the proposed Regulation is estimated to cost $499,218 less than the "equitable" scenario. Much of the additional cost burden would be borne by mid-size and smaller plants. For example, the cost of the monitoring activities for Canada Pipe would increase $115,801 from $38,391 to $154,192. The costs to Franklin and Fahramet would increase by over $94,000 each.

The cost difference between the two scenarios is a measure of the cost-effectiveness of the pipe-specific approach proposed for the metal casting sector. The MOE has been cognizant of the potential financial implications of the MISA requirements, and has incorporated such considerations in the development of the monitoring regulations.

FIGURE 2.9

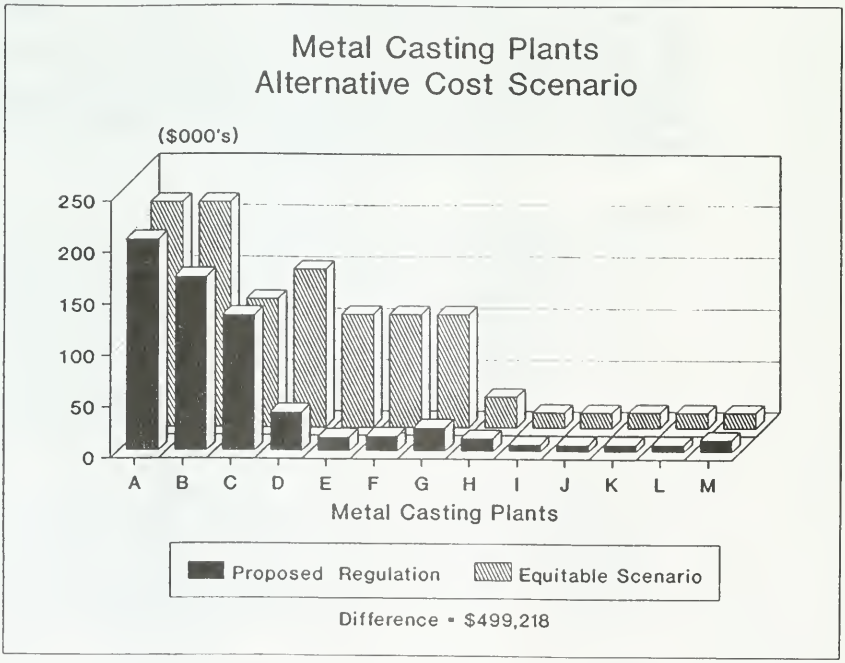


TABLE 2.5
COMPARISON OF ALTERNATIVE ANALYTICAL AND TOXICITY TESTING COST SCENARIOS

	COMPANY	COSTS: PROPOSED REGULATION	COSTS: "EQUITABLE SCENARIO"		DIFFERENCE
A-	FORD	$206,135	$219,344	(109,672 X 2)	$13,209
B-	G.M.	$169,534	$219,344	(109,672 X 2)	$49,810
C-	HALEY	$132,632	$124,512	(109,672 + 14,840)	($8,120)
D-	CANADA PIPE	$38,391	$154,192	(109,672 + (3)(14,840))	$115,801
E-	FRANKLIN	$14,176	$109,672		$95,496
F-	FAHRAMET	$14,837	$109,672		$94,835
G-	CROWE	$22,563	$109,672		$87,109
H-	WESTERN	$13,146	$29,680		$16,534
I-	CANADA ALLOY	$6,757	$14,840		$8,083
J-	ACUSTAR	$7,489	$14,840		$7,351
K-	BOWMANVILLE	$6,855	$14,840		$7,985
L-	MAGALLOY	$6,855	$14,840		$7,985
M-	RICHMOND	$11,700	$14,840		$3,140
		$651,070	$1,150,288		$499,218

UNIT PRICE PER STREAM

PROCESS= $95,592(ROUTINE)+$3,480(CHARACTERIZATION)+$3,400(OPEN)+$7,200(TOXICITY)=$109,672
COOLING WATER= $5,560(ROUTINE)+$3,480(CHARACTERIZATION)+$3,400(OPEN)+2400(TOXICITY)=$14,840
STORM WATER=$5,560(ROUTINE)

NOTE: * The analytical costs in the proposed regulation exceed the estimated costs in the equitable scenario for Haley because additional analytical testing is required of a stream converted from process water.

3.0 ECONOMIC EFFECTS AND IMPLICATIONS OF MONITORING COSTS

3.1 Industry Performance

Although the Ontario and Canadian economies have displayed strong growth in GDP since the early 1980s recession, the metal casting industry has not experienced similar growth (Deloittes, Haskins and Sells, 1988). Demand for castings has stablized after years of decline which resulted from a greater availability of substitute materials, a decrease in size and weight of major durable goods, the advance of alternative production technologies and the demise of traditional industries that required a large amount of metal cast parts. The metal casting industry also experiences strong competition and is characterized by easy exit and entry.

The demand for castings is primarily driven by the demand for durable goods. Current economic trends in Canada and Ontario indicate a growing economy and a currently strong demand for durable goods for consumption and investment. Moderate growth is expected for the Canadian economy over the next three years, with stable demand for durable goods and therefore castings (Deloitte Haskins and Sells, 1988). A recession, which appears unlikely at this time, could drastically reduce the demand for durable goods and the demand for castings.

The limited financial information available for individual metal casting companies indicates that the firms have recovered from the large losses earlier in the decade and are beginning to earn a reasonable rate of return on capital. Profitability does, however, vary widely in the industry, with some companies still experiencing losses and insolvency and other companies earning substantial net incomes (Deloitte, Haskins and Sells, 1988).

Financial data are seldom available for individual plants, although it is at this level where financial consequences can often influence decisions or affect the viability of an operation. Six of the 13 metal casting plants belong to private corporations, which do not publish financial statement. Another six of these plants are divisions or subsidiaries of public corporations for which financial data are available. For some of these firms, a limited amount of disaggregated data on the metal casting

segments of their businesses is published. Where they are available, these data will be used in the analyses rather than consolidated company data. Only for one firm, Haley industries, is plant specific financial data available. Nevertheless, financial information was collected from the public domain for eight of the 13 firms.

The information was assembled from: Deloitte, Haskins and Sells (1988), company published financial statements, and other references. Relevant financial performance information can be found in Appendices F-I. These data are not complete but they show that following reduced earnings or losses for many of the firms in 1982 and 1983, performance has generally improved. After-tax profits have generally increased over the period for the eight casting firms.

3.2 Analytical Procedures

Monitoring costs incurred by the firms under the MISA Regulations will increase operating expenses and, unless there is some offsetting increase in productivity associated with wastestream monitoring, profits to the firms and returns on particular plants will be reduced in the short-run at any rate. In this section, economic effects of these costs on the industry and on those firms for which financial data are available will be examined.

The approach taken in this analysis will be to estimate how the appropriate incremental monitoring costs would affect historic after-tax profits, capital expenditures and the return on capital employed by each firm. The analysis will show how the monitoring costs would have changed each firm's performance measures if they had been incurred during the worst year over the past four to six years and how they might have affected the average financial performance over the past four to six years for which relevant data are available. These analyses reveal the extent to which monitoring costs would reduce a company's performance measures below its own historical averages. Moreover, comparisons can be made with these same performance measures for the industry as a whole where they are available.

Where long term investment decisions are concerned, a key economic variable is the rate of return on investment or capital employed. This is the reward

that provides the incentive for owners and investors to remain in a particular enterprise or, where it is lacking, to move on to something else. In this study, the Statistics Canada definition of return on capital employed was used:

$$\frac{\text{After-tax Profits + Interest Payments + Extra-ordinary Expenses}}{\text{Total Assets - Current Liabilities}}$$

Consequently, the first analysis will show how the potentially recurring operating costs of monitoring would have affected the rate of return on capital employed for individual firms for which financial data are available.

For this analysis, operating costs of monitoring were first reduced by the amount of the appropriate corporate tax rate because part of these costs are offset by reduced income taxes. The adjusted incremental operating cost of monitoring was then subtracted from after-tax profits to determine a new rate of return on capital employed. This calculation was carried out for each firm in each year for which data were available. The new rates of return could then be compared with average rates of return for the industry as well as each firm's historical performance records.

Another analytical approach involves calculating the ratio of operating costs of monitoring to after-tax profits. This ratio indicates the proportion of after-tax profits, assuming the firm was unable to pass on any of the monitoring costs as increased prices, that would have to be diverted to monitoring activities. This calculation yields an over-estimate of the effect because operating costs of monitoring are not reduced by the corporate tax rates as was done in the previous analysis. Moreover, there is no provision for increased prices to offset this cost increase.

A third analytical procedure was carried out to determine the extent to which capital requirements for monitoring would divert capital expenditure away from other uses. Estimated capital costs of monitoring were thus computed as a percent of total capital expenditures for each firm in each year for which capital expenditure data are available. There is no rule of thumb as to what proportion of capital expenditures should be devoted to environmental protection in any given year. Some industrial representatives assert that a minimum

capital expenditure is necessary to carry out a sufficient amount of repair and replacement in order to keep a plant running. These basic expenditures apparently vary from industry to industry and from firm to firm.

Although an analysis of the impact of capital costs on income was not conducted, it is interesting to note that environmental capital expenditures can be fully deducted against income over a three year period at the rate of 25%, 50%, and 25%. Therefore, the reduction to income in a single year would be less than the full amount of capital expenditures that is used in this analysis.

International competitiveness can be affected by environmental expenditures to the extent that firms may be unable to maintain product quality or pass along cost increases in the face of international market-determined competitive prices for specific products.

These analyses are by no means definitive but they can identify those firms which could experience financial effects that are large relative to (a) their own historical performance, (b) other firms' performance in the same industry, and/or (c) industry performance.

While it would be ideal to assess the consequences of increased costs on individual plants, assessments at the level of the firm are better than no information at all.

Finally, where a company believes that it will suffer undue financial burdens by complying with environmental requirements, it may request a detailed financial analysis under provisions of the Ministry's Policy and Procedures Manual (Policy 02-01). Proprietary data used in these analyses would remain confidential under the provisions of The Ontario Freedom of Information Act.

3.3 Economic and Financial Implications

As noted, financial information on eight of the 13 metal casting firms can be found in Appendices F-I. Where financial information was not available at the plant level the next reporting level was used. For Acustar Canada Inc. financial information was obtained from Chrysler U.S. Financial information for Falconbridge Ltd. and its

Indusmin Division were used for Fahramet Steel Castings Indusmin Division. Franklin Electric Company Inc. financial information was used for its subsidiary, Franklin Electric of Canada Ltd.

Table 3.1 below presents a summary of the percentage reduction in the rate of return on investment that would be imposed for the eight metal casting plants for which data are currently available. On average, operating costs of monitoring would reduce company rates of return by up to 0.58%. The largest percentage reduction was for Bowmanville Foundries.

Table 3.2 presents a summary of the effects of expected monitoring costs on after-tax profits (net earnings) and capital expenditures for eight of the 13 metal casting firms.

As indicated, percentages are computed for the highest, lowest and average net earnings and capital expenditures for the period 1982 to 1987.

TABLE 3.1

PERCENTAGE REDUCTION ON RETURN ON AVERAGE CAPITAL EMPLOYED DUE TO INCREMENTAL OPERATING COST

FIRM	PERCENTAGE REDUCTION (shown in negative)
Bowmanville	-0.58%
Canron Inc. (1)	-0.02%
Chrysler U.S. (2)	<01%
Falconbridge (3)	<01%
Franklin U.S. (4)	-0.01%
Ford	-0.02%
General Motors	-0.01%
Haley	-0.46%

Source: Company Annual Financial Statement

(1) Canron Pipe Company Ltd., has changed name and ownership. It is now Canada Pipe Company Ltd., a wholly owned subsidiary of McWane Inc., located in Birmingham, Alabama. For the purpose of this report Canron financial data has been used.

(2) Consolidated Chrysler U.S. financial data were used for Acustar Canada Inc.

(3) Consolidated Falconbridge financial data were used for Fahramet Steel Castings Indusmin Division.

(4) Consolidated Franklin U.S. financial data were used for Franklin Electric of Canada Ltd.

Figure 3.1 below shows the estimated capital costs for monitoring as a percentage of average annual capital expenditure per plant, and the estimated annual operating costs for monitoring as a percentage of average after-tax profit per plant. These rates are derived from Table 3.2.

FIGURE 3.1

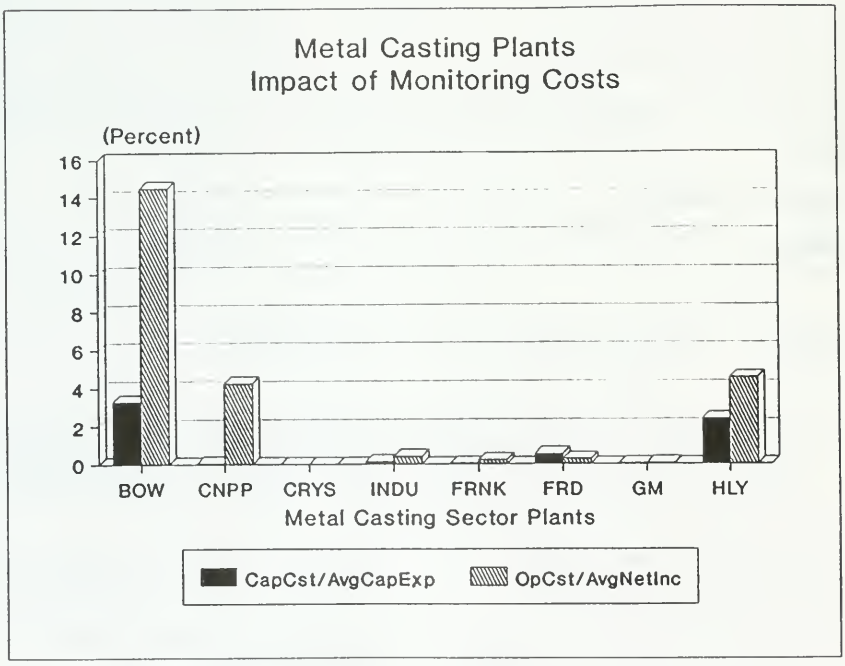


TABLE 3.2

IMPACT OF MONITORING COSTS ON SELECTED FINANCIAL INDICATORS
(1982 - 1987)

PLANT	CAPITAL EXPENDITURES			AFTER-TAX EARNINGS		
	Monitoring Capital Cost as a % of Annual Average Capital Expenditure			Monitoring Operating Cost as a % of Annual Average After-Tax Earnings (Loss)		
	Highest Year	Lowest Year	Average Over 1982-87	Highest Year	Lowest Year	Average Cost 1982-87
BOWMANVILLE	1.203	160.0	3.200	6.211	(17.544)	14.493
CANADA PIPE (Canron) (1)	0.027	0.216	0.054	0.360	(0.160)	4.555
CHRYSLER U.S. (Acustar)	0.001	0.005	0.001	0.000	0.006	0.001
INDUSMIN (Fahramet) (2)	0.109	0.189	0.144	0.244	1.871	0.414
FRANKLIN U.S.	0.036	0.079	0.046	0.168	0.289	0.224
FORD	0.031	0.078	0.530	0.106	(0.293)	0.273
GENERAL MOTORS	0.018	0.089	0.037	0.025	(0.305)	0.050
HALEY	1.178	5.701	2.385	2.487	7.950	4.546

Source: Monitoring Costs and their Implications for Direct Dischargers in the Ontario Metal Casting Sector, 1989.

Note: (1) Canron Pipe Co. Ltd. has changed name and ownership. It is now Canada Pipe Company Ltd. a wholly owned subsidiary of McWane Inc. located in Birmingham, Alabama. For the purpose of this report Canron financial data have continued to be used.

(2) Capital expenditure and earning figures represent those of the Indusmin Division and were obtained from Falconbridge financial statement.

Capital costs, when viewed in terms of average annual capital expenditures over the 1982 to 1987 period, represent between 0.001% (for Acustar owned by Chrysler U.S.) to 2.385% (for Haley) of such expenditures. These costs appear to be fiscally manageable for these firms.

Figure 3.1 and Table 3.2 indicate that monitoring operating costs in relation to average annual-after tax profits over the 1982 to 1987 period, range from approximately 0% for Chrysler (Acustar) to 14% for Bowmanville. The bar graphs in Figure 3.1 highlight potential impacts of monitoring operating costs as a percentage of annual after-tax earnings. As shown in the Figure and Table, in only one plant are monitoring operating costs greater than 5% of annual average after-tax earnings.

The monitoring operating cost as a percentage of annual average after-tax earnings for Bowmanville Foundry Company is estimated at 14.5%. Bowmanville is a private company and under new ownership, however financial information is available from 1983 to 1986. The company's record of profitability was not impressive. After-tax profit in 1984 was quite high ($161,600), with an 18% return on capital, but profits declined for the subsequent two years. However, the company had a solid financial base. It had no debt and extremely high current and quick ratios in each year from 1983 to 1986. Therefore, there is no reason to believe that Bowmanville would find the estimated total cost of $11,555 for the Regulation fiscally unmanageable.

The next largest impacts of 4.5%, for monitoring operating cost as a percent of annual after-tax earnings, occur at Canada Pipe and Haley. Canron Pipe Company Ltd. has changed both name and ownership. It is now Canada Pipe Company Ltd., a wholly owned subsidiary of McWane Inc., located in Birmingham, Alabama. For the purpose of this report, financial data for Canron has continued to be used. Canron has maintained a fairly stable financial position over the years 1982 to 1986. The working capital ratio has averaged 2.5:1 and the debt to equity ratio has been constant at 1:2. Profitability has steadily increased between 1982 and 1986. The company reported a major loss of approximately $34 million in 1982, partly a result of a reorganization to shed losing divisions. When this year, which is clearly an anomaly, is removed from the analysis, the impact of operating costs on average annual after-tax earnings is reduced to a much less significant level.

One of the five remaining firms for which financial information is not available, Magalloy, has stated its intention to eliminate its direct discharge. Three of the remaining four firms, Canada Alloy, Richmond Die Casting and Western Foundry, face costs of approximately $11,000, $16,000 and $17,000 respectively. Crowe Foundry faces an estimated cost of over $46,000, however no financial data are available to evaluate the impact of these costs on the firm.

Therefore, the impacts of the incremental costs are varied for individual firms but do not appear to be fiscally unmanageable. If companies such as Crowe Foundry, are particularly concerned about the implications of the monitoring costs on their operations, plant-specific financial data will be required to evaluate financial impacts in more detail.

Two further qualifications regarding the proposed monitoring costs on the metal casting plants are noted.

First, monitoring costs cited in this report constitute only a part of the environmental protection costs which this, and other, industrial sectors will face in Ontario, and elsewhere for that matter. One of the firms in the metal casting industry, Falconbridge Limited, operate plants in other industrial sectors which are subject to MISA Monitoring Regulations.

Furthermore, direct discharger firms may face additional costs of further abatement of water, air and solid waste pollutants as new requirements are put in place. Under MISA, effluent limits regulations will be promulgated and regulations concerning air pollution control are being amended which could imply further costs (Ontario Ministry of the Environment, November 1987).

These cumulative cost burdens may be further increased by regulatory requirements for workplace health and safety and for consumer protection which are administered by other provincial and federal government agencies.

A second qualification has the potential to offset the cost burden to an industry or an individual firm. Depending on the market structure of the industry and demand conditions facing Ontario firms, companies will be able to pass on some or all incremental costs in the form of higher prices.

Vertically integrated operations, such as Ford and General Motors, are more likely to be able to divert some of their costs by increasing their product prices.

The ability to pass on costs also depends on the range of regulatory costs which befall each plant or firm.

Although the emphasis of this report has been on the cost of monitoring, there are benefits that should be noted.

Potential benefits to the metal casting plants required to monitor include reduced operating costs due to reduced water usage and process material losses, and goodwill gained by demonstrating to the public that the company is a good corporate citizen responding to environmental problems.

The monitoring requirements may induce a small, but positive impact on employment because extra staff may be required to take samples, maintain equipment and report data. Temporary increases in construction activity are expected at some of the plants. Furthermore, demand for laboratory services as well as flow measurement and sampling equipment from these plants will increase during the period of the monitoring regulation. The monitoring data base will be available to design cost-effective control programs aimed at the virtual elimination of toxic contaminants at their source.

Finally, the benefits of reducing pollution include enhanced recreation activities, better drinking water, improved aesthetics and the knowledge that our society has taken a step towards preserving our water for generations to come.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Conclusions reached in this review are as follows:

(a) Incremental capital costs for the 13 metal casting plants are estimated at $535,000, and range on a per plant basis from $1,600 to $238,000.

(b) Operating cost estimates for the 12 month period range from $9,000 to $316,000 per plant, and total approximately $884,000.

(c) The point estimate of the total incremental costs for complying with the Regulation is approximately $1.4 million.

(d) The diversity of the plants in the metal casting sector results in a wide range of incremental costs. Three of the largest plants will account for roughly 82% of total estimated expenditures. The remaining 10 smaller operations will account for 18% of potential monitoring expenditures.

(e) Plants have identified opportunities to reduce their costs through modifications to their processes or discharge infrastructure. The estimated savings to one plant alone, by modifying its effluent streams so that it can reduce its number of sampling requirements, is $111,000.

(f) The percentage reductions on average return on capital employed due to incremental monitoring operating cost range from less than 0.01% up to 0.58%.

(g) Capital costs, when viewed in terms of average annual capital expenditures over the 1982 to 1987 period, represent up to 2.4% of such expenditures.

(h) Operating costs of monitoring would have reduced annual average after-tax profits by .001% to 14%.

(i) Financial impacts on the individual metal casting plants subject to MISA monitoring requirements are varied, but do not appear to be fiscally unmanageable.

(j) Potential benefits to the metal casting plants required to monitor effluents include reduction to operating costs by reducing water usage and process material losses, and goodwill gained by demonstrating to the public that the company is a good corporate citizen responding to environmental problems.

(k) The monitoring requirements may induce a small, but positive impact on employment because extra staff may be required to take samples, maintain equipment and report data. Temporary increases in construction activity are expected at some of the plants.

(l) Demand for laboratory services as well as flow measurement and sampling equipment from these plants will increase during the period of the Monitoring Regulation.

(m) The monitoring data base will be available to design cost-effective control programs aimed at virtual elimination of toxic contaminants at their source.

4.2 Recommendations

In order to identify possible problems at an early stage, it is recommended that the Ministry of the Environment and the industry work together to identify the actual incremental capital and operating costs of the monitoring requirements in the early portion of the Regulation period. Early identification of possible financial burdens will enable this Ministry and the individual plant to review and devise workable solutions.

Also, at the end of the Regulation period, it is recommended that each plant report the actual incremental costs incurred due to the MISA monitoring requirements in order to:

- validate and improve the cost-estimation procedures used in this report.

- monitor and assess the financial and employment impacts of the monitoring requirements.

The cumulative financial burdens of monitoring requirements in other sectors, other MISA requirements, air and solid waste control

regulations and regulatory requirements by other federal and provincial agencies should be monitored.

Finally, when monitoring data and activities at these plants (and other industrial dischargers) are audited by Ministry of the Environment personnel or their agents, information should be gathered to determine whether the monitoring activities or data have been, or could be, helpful in making the operations or processes more efficient and productive.

APPENDICES

A - I

APPENDIX A

TABLE A-1

SUMMARY ESTIMATES OF THE
INCREMENTAL COSTS BY PLANT FOR THE
13 METAL CASTING PLANTS

Plant	Location	1989 $ IN THOUSANDS Operating	Capital	Total
Acustar	Etobicoke	13.6	22.5	36.1
Bowmanville	Bowmanville	10.0	1.6	11.6
Canada Alloy	Kitchener	9.1	1.7	10.8
Canada Pipe	Hamilton	54.3	11.8	66.1
Crowe	Cambridge	29.9	15.6	45.5
Fahramet	Orillia	16.5	6.6	23.1
Ford	Windsor	316.1	180.0	496.1
Franklin	Strathroy	16.4	2.3	18.7
G.M.	St. Catharines	218.5	238.0	456.5
Haley	Haley Station	160.2	50.0	210.2
Magalloy	Stratford	8.9	1.6	10.5
Richmond	Cornwall	14.4	1.7	16.1
Western	Wingham	15.8	1.6	17.4
TOTALS (rounded)		884.0	535.0	1,419.0

APPENDIX B (TABLE B-1)

TOTAL COSTS TO COMPANIES ASSOCIATED WITH MONITORING REGULATION (INCLUDES MEETINGS AND PRE-REGULATION

Monitoring Activities	Total	Acustar	Bowmanville	Can.Alloy	Cn.Pipe	Crowe	Fahramet	Ford	Franklin	G.M.	Haley	Magalloy	Richmond	Western
Sampling:														
-Operating	$144,170	$3,560	$1,650	$1,540	$12,700	$2,800	$1,120	$60,000	$1,400	$40,000	$14,000	$1,440	$2,030	$1,930
-Capital	$196,750	$2,500	$1,600	$1,700	$1,800	$10,500	$1,600	$120,000	$2,100	$38,000	$12,000	$1,600	$1,750	$1,600
Total Sampling	$340,920	$6,060	$3,250	$3,240	$14,500	$13,300	$2,720	$180,000	$3,500	$78,000	$26,000	$3,040	$3,780	$3,530
Flow Measurement														
-Operating	$25,610	$1,000	$300	$30	$1,900	$2,500	$0	$10,000	$150	$5,000	$4,000	$120	$250	$360
-Capital	$321,900	$20,000	$0	$0	$10,000	$4,700	$5,000	$50,000	$200	$200,000	$32,000	$0	$0	$0
Total Flow Measurement	$347,510	$21,000	$300	$30	$11,900	$7,200	$5,000	$60,000	$350	$205,000	$36,000	$120	$250	$360
Initial Report														
-Operating	$28,520	$480	$800	$290	$500	$560	$120	$20,000	$200	$1,000	$4,000	$320	$125	$125
-Capital	$175	$0	$0	$0	$0	$175	$0	$0	$0	$0	$0	$0	$0	$0
Total Initial Report	$28,695	$480	$800	$290	$500	$735	$120	$20,000	$200	$1,000	$4,000	$320	$125	$125
Reporting														
-Operating	$34,830	$1,060	$350	$450	$860	$1,500	$400	$20,000	$450	$3,000	$6,000	$210	$280	$270
-Capital	$16,250	$0	$0	$0	$0	$250	$0	$10,000	$0	$0	$6,000	$0	$0	$0
Total Reporting	$51,080	$1,060	$350	$450	$860	$1,750	$400	$30,000	$450	$3,000	$12,000	$210	$280	$270
Sub-Total	$768,205	$28,600	$4,700	$4,010	$27,760	$22,985	$8,240	$290,000	$4,500	$287,000	$78,000	$3,690	$4,435	$4,285
Total Routine Monitoring	$537,890	$6,289	$5,655	$5,557	$26,127	$10,402	$5,557	$185,179	$4,724	$142,645	$117,654	$5,655	$10,500	$11,946
Total Characterization	$50,586	$0	$0	$0	$6,464	$6,361	$6,880	$6,956	$7,052	$12,889	$3,984	$0	$0	$0
Total Open Characterization	$23,800	$0	$0	$0	$3,400	$3,400	$0	$6,800	$0	$6,800	$3,400	$0	$0	$0
Total Toxicity	$38,400	$1,200	$1,200	$1,200	$2,400	$2,400	$2,400	$7,200	$2,400	$7,200	$7,200	$1,200	$1,200	$1,200
Total Cost to Plants For Monitoring Regulation	$1,418,881	$36,089	$11,555	$10,767	$66,151	$45,548	$23,077	$496,135	$18,676	$456,534	$210,238	$10,545	$16,135	$17,431
Pre-Reg Characterization and Meeting/Consultation	$143,925	$15,000	$1,800	$500	$1,250	$725	$3,000	$56,000	$500	$35,000	$25,000	$500	$500	$4,150
Total Costs to Plants	$1,562,806	$51,089	$13,355	$11,267	$67,401	$46,273	$26,077	$552,135	$19,176	$491,534	$235,238	$11,045	$16,635	$21,581

APPENDIX C
FACTORS AND ASSUMPTIONS CONSIDERED

Cost Estimation: Cost estimates for the 13 metal casting plants were based on some general assumptions.

(1) The company and Ministry of the Environment cost estimates were based on monitoring requirements as noted in "The Development Document for the Effluent Monitoring Regulation for the Metal Casting Sector", Water Resources Branch, November 1989.

(2) Average prices from M.M. Dillon, Inventory and Critical Review of Laboratory Resources, Toronto, 1988 were used to estimate analytical costs.

Transportation: Based on estimates of courier transportation costs submitted by the casting plants, transportation cost to the labs per sampling point was estimated at approximately $1,000. This estimate was used for those plants that did not submit a transport estimate.

Refrigeration: It is assumed that all companies will require storage refrigerators for the samples. Therefore, $1,500 was applied to those companies that did not report a storage refrigerator in their cost estimates.

Canada Alloy: A Pre-Regulation cost estimate of $500 was made representing the lowest estimate submitted by the companies.

Canada Pipe Co.: Canron Pipe Co. Ltd. has changed name and ownership. It is now Canada Pipe Company Limited a wholly owned subsidiary of McWane Inc. located in Birmingham, Alabama. For the purpose of this report, Canron financial data have continued to be used.

Haley Industries: Haley Industries reduced its monitoring requirements, and therefore the cost of the Regulation, through physical adjustments to its infrastructure which altered the classification of one of its effluent streams from process water to storm water. The cost reduction was based on the estimated cost of the current requirements and the previous estimated cost to meet the requirements prior to the infrastructure adjustments and effluent stream reclassification (see Appendix E).

APPENDIX C
FACTORS AND ASSUMPTIONS CONSIDERED
(CONTINUED)

Richmond:

The company has assumed two sampling points in their estimate, since they have chosen to monitor intake as well as discharge. Therefore the analytical cost estimate was doubled.

If the company chose not to monitor intake water, the savings in operating and analytical costs are estimated to be over $6,500.

Magalloy:

Magalloy had notified the Ontario Ministry of the Environment of its intention to recirculate its cooling water, thereby eliminating its effluent stream. The preliminary estimated cost was approximately $6,000, which is lower than the $10,545 estimated cost of complying with the Regulation. However, since Magalloy has not as yet eliminated its direct discharge it will be included in the Regulation.

A. H. Tallman:

A.H. Tallman has been deleted from the Monitoring Regulation since the company is now discharging to a sanitary sewer and will be subject to the requirements of the MISA Sewer Use Control Program.

APPENDIX D

TRANSPORTATION COST ESTIMATE TO LAB BY COURIER

Based on estimates of courier transportation costs submitted.

Company	Toxicity	Sampling Points	Cost
Canron	yes	5 *	$3,600
Fahramet	yes	1	$680
Haley	yes	2	$4,000
		8	$8,280

Transportation cost per sampling point estimated at approximately $1,000.

This estimate was used for those companies that did not submit a transport estimate.

Acustar estimate of $300 was not factored into calculation because the plant has no toxicity requirement and is located in Metro Toronto.

* The transport cost estimate provided by Canron (now Canada Pipe) reflected requirements for 5 sampling points.

APPENDIX E

HALEY INDUSTRIES
COMPARISON OF TWO SCENARIOS

Costs	PRIOR	CURRENT	SAVINGS
Sampling:			
-Operating	$28,000	$14,000	$14,000
-Capital	$12,000	$12,000	$0
Total Sampling	$40,000	$26,000	$14,000
Flow Measurement			
-Operating	$8,000	$4,000	$4,000
-Capital	$32,000	$32,000	$0
Total Flow Measurement	$40,000	$36,000	$4,000
Initial Report			
-Operating	$4,000	$4,000	$0
-Capital	$0	$0	$0
Total Initial Report	$4,000	$4,000	$0
Reporting			
-Operating	$12,000	$6,000	$6,000
-Capital	$6,000	$6,000	$0
Total Reporting	$18,000	$12,000	$6,000
Sub-Total	$102,000	$78,000	$24,000
Total Routine Monitoring	$190,096	$117,654	$72,442
Total Characterization	$7,968	$3,984	$3,984
Total Open Characterization	$6,800	$3,400	$3,400
Total Toxicity	$14,400	$7,200	$7,200
Total Cost to Plant For Monitoring Regulation	$321,264	$210,238	$111,026

NOTES: PRIOR = ESTIMATED COST PRIOR TO ADJUSTMENTS TO EFFLUENT STREAMS.
CURRENT = CURRENT ESTIMATED COST AFTER ADJUSTMENTS TO EFFLUENT STREAMS AND MONITORING REQUIREMENTS.
SAVINGS = REDUCED COST TO COMPANY DUE TO ADJUSTMENTS.

APPENDIX F

TABLE F-1
SELECTED FINANCIAL STATISTICS
1982-1987
in 000's of Dollars

	1982	1983	1984	1985	1986	1987	Average
Bowmanville							
Net Income	N/A	($57)	$161	$97	$76	N/A	$69
Capital Expenditures	N/A	$1	$33	$32	$133	N/A	$50
Canron Inc.							
Net Income	($33,937)	$2,670	$6,550	$11,489	$15,080	$5,300	$1,192
Capital Expenditures	$5,467	$7,488	$21,518	$26,300	$44,300	$27,045	$22,020
Chrysler U.S.(in $U.S. millions)							
Net Income	$170	$701	$2,373	$1,610	$1,389	$1,290	$1,256
Capital Expenditures	$374	$1,058	$1,247	$1,535	$2,061	$1,936	$1,369
Indusmin Division							
Net Income	$882	$3,533	$4,102	$3,086	$6,749	$5,561	$3,986
Capital Expenditures	N/A	N/A	N/A	$3,485	$4,198	$6,072	$4,585
Franklin U.S.(in $U.S. thousands)							
Net Income	N/A	$5,500	$5,800	$4,700	$6,200	$8,100	$6,060
Capital Expenditures	N/A	$4,166	$4,712	$5,262	$2,392	$4,074	$4,121

Source: Company consolidated annual reports and Financial Post Information Service.

APPENDIX F

TABLE F-1 (continued)
SELECTED FINANCIAL STATISTICS
1982-1987
in 000's of Dollars

	1982	1983	1984	1985	1986	1987	Average
Ford							
Net Income	($107,800)	$119,900	$299,500	$199,000	$101,100	$83,600	$115,883
Capital Expenditures	$229,600	$254,700	$246,300	$295,800	$426,400	$582,000	$339,133
General Motors							
Net Income	($71,686)	$675,570	$880,764	$712,975	$418,415	$5,070	$436,851
Capital Expenditures	$324,105	$342,070	$267,472	$674,492	$1,318,262	$928,476	$642,480
Haley							
Net Income	$2,105	$2,015	$3,029	$4,252	$6,442	$3,303	$3,524
Capital Expenditures	$2,163	$877	$324	$1,137	$4,243	$3,830	$2,096

Source: Company consolidated annual reports and Financial Post Information Service.

APPENDIX G

TABLE G-1
REGULATION OPERATING COST IMPACT ON NET INCOME
in 000's of Dollars

	NET INCOME			OPERAT			
	HIGH	LOW	AVERAGE	EXPEND	%HIGH	%LOW	%AVERAGE
Bowmanville	$161.0	($57.0)	$69.0	$10.0	6.211%	-17.544%	14.493%
Canada Pipe (Canron) (1)	$15,080.0	($33,937.0)	$1,192.0	$54.3	0.360%	-0.160%	4.555%
Chrysler U.S.($U.S. millions) (2) ($C=.83$U.S. applied to operating cost estimate)	$2,373.0	$170.0	$1,256.0	$0.011	0.000%	0.006%	0.001%
Indusmin Division (Fahramet) (3)	$6,749.0	$882.0	$3,986.0	$16.5	0.244%	1.871%	0.414%
Franklin U.S. (4) ($C=.83$U.S. applied to operating cost estimate)	$8,100.0	$4,700.0	$6,060.0	$13.6	0.168%	0.289%	0.224%
Ford	$299,500.0	($107,800.0)	$115,883.0	$316.1	0.106%	-0.293%	0.273%
General Motors	$880,764.0	($71,686.0)	$436,851.0	$218.5	0.025%	-0.305%	0.050%
Haley	$6,442.0	$2,015.0	$3,524.0	$160.2	2.487%	7.950%	4.546%

NOTES:

Operat Expend = Estimated operating expenditures to comply with Regulation.

SOURCE: Company consolidated annual reports and Financial Post Information Service.

(1) Canron Pipe Col. Ltd. has changed name and ownership. It is now Canada Pipe Company Ltd. a wholly owned subsidiary of McWane Inc. located in Birmingham, Alabama. For the purpose of this report we have continued to use Canron financial data.

(2) Consolidated Chrysler U.S. financial data were used for Acustar Canada Inc.

(3) Indusmin Division financial data were used for Fahramet Castings and were obtained from Falconbridge Limited financial statements.

(4) Consolidated Franklin U.S. financial data were used for Franklin Electric of Canada Ltd.

APPENDIX H

TABLE H-1
IMPACT OF REGULATION CAPITAL COSTS AS A
PERCENTAGE OF ANNUAL CAPITAL EXPENDITURES
in 000's of Dollars

Capital Expenditures	HIGH	LOW	AVERAGE	REG	%HIGH	%LOW	%AVERAGE
Bowmanville	$133.0	$1.0	$50.0	$1.6	1.203%	160.000%	3.200%
Canada Pipe(Canron) (1)	$44,300.0	$5,467.0	$22,020.0	$11.8	0.027%	0.216%	0.054%
Chrysler U.S.($U.S. millions (2) ($C=.83$U.S. applied to Reg estimate)	$2,061.0	$374.0	$1,369.0	$0.019	0.001%	0.005%	0.001%
Indusmin Division (Fahramet) (3)	$6,072.0	$3,485.0	$4,585.0	$6.6	0.109%	0.189%	0.144%
Franklin U.S. (4) ($C=.83$U.S. applied to Reg estimate)	$5,262.0	$2,392.0	$4,121.0	$1.9	0.036%	0.079%	0.046%
Ford	$582,000.0	$229,600.0	$339,133.0	$180.0	0.031%	0.078%	0.053%
General Motors	$1,318,262.0	$267,472.0	$642,483.0	$238.0	0.018%	0.089%	0.037%
Haley	$4,243.0	$877.0	$2,096.0	$50.0	1.178%	5.701%	2.385%

NOTES:

Reg = Estimated capital requirement to comply with Regulation.

SOURCE: Company consolidated annual reports and Financial Post Information Service.

(1) Canron Pipe Co. Ltd. has changed name and ownership. It is now Canada Pipe Company Ltd. a wholly owned subsidiary of McWane Inc. located in Birmingham, Alabama. For the purpose of this report we have continued to use Canron financial data.

(2) Consolidated Chrysler U.S. financial data were used for Acustar Canada Inc.

(3) Indusmin Division financial data were used for Fahramet Castings and were obtained from Falconbridge Limited financial statements.

(4) Consolidated Franklin U.S. financial data were used for Franklin Electric of Canada Ltd.

APPENDIX I

TABLE I-1
IMPACT OF OPERATING COST ON RETURN ON CAPITAL EMPLOYED
in 000's of Dollars

	1982	1983	1984	1985	1986	1987	Average
Bowmanville							
Capital Employed	N/A	$746	$907	$1,004	$1,080	N/A	$934
ADJ operating	-	$5.4	$5.4	$5.4	$5.4	-	$5.4
Dif ROCE	-	-0.72%	-0.60%	-0.54%	-0.50%	-	-0.58%
(tax =46%)							
Canron Inc.							
Capital Employed	$123,417	$160,012	$166,288	$213,580	$134,426	$198,454	$166,030
ADJ operating	$29.3	$29.3	$29.3	$29.3	$29.3	$29.3	$29.3
Dif ROCE	-0.02%	-0.02%	-0.02%	-0.01%	-0.02%	-0.01%	-0.02%
(tax =46%)							
Chrysler U.S.(in $U.S. millions)							
Capital Employed	$1,859	$2,230	$4,042	$6,532	$7,615	$9,836	$5,352
ADJ operating	$0.00001	$0.00001	$0.00001	$0.00001	$0.00001	$0.00001	$0.00001
Dif ROCE	-0.0000004%	-0.0000003%	-0.0000002%	-0.0000001%	-0.0000001%	-0.0000001%	-0.0000001%
(tax =37%)							
Falconbridge							
Capital Employed	$871,914	$958,706	$919,836	$1,070,155	$2,427,420	$2,256,647	$1,417,446
ADJ operating	$8.9	$8.9	$8.9	$8.9	$8.9	$8.9	$8.9
Dif ROCE	-0.0010%	-0.0009%	-0.0010%	-0.0008%	-0.0004%	-0.0004%	-0.0006%
(tax =46%)							
Franklin U.S. (in $U.S. thousands)							
Capital Employed	N/A	$70,600	$73,300	$57,600	$62,000	$68,000	$66,300
ADJ operating	-	$9	$9	$9	$9	$9	$9
Dif ROCE	-	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
(tax =37%)							

APPENDIX I
(continued)
TABLE I-1
IMPACT OF OPERATING COST ON RETURN ON CAPITAL EMPLOYED
in 000's of Dollars

	1982	1983	1984	1985	1986	1987	Average
Ford							
Capital Employed	$786,700	$856,600	$1,138,200	$1,082,100	$1,179,300	$1,371,900	$1,069,133
ADJ operating	$170.7	$170.7	$170.7	$170.7	$170.7	$170.7	$170.7
Dif ROCE (tax =46%)	-0.02%	-0.02%	-0.01%	-0.02%	-0.01%	-0.01%	-0.02%
General Motors							
Capital Employed	$919,116	$1,479,343	$1,760,094	$2,230,026	$2,532,125	$2,859,830	$1,963,422
ADJ operating	$118.0	$118.0	$118.0	$118.0	$118.0	$118.0	$108.1
Dif ROCE (tax =46%)	-0.01%	-0.01%	-0.01%	-0.01%	0.00%	0.00%	-0.01%
Haley							
Capital Employed	$13,486	$14,720	$19,031	$19,031	$23,449	$23,091	$18,801
ADJ operating	$86.5	$86.5	$86.5	$86.5	$86.5	$86.5	$86.5
Dif ROCE (tax =46%)	-0.64%	-0.59%	-0.45%	-0.45%	-0.37%	-0.37%	-0.46%

NOTES:

Dif ROCE = Difference to Return On Capital Employed resulting from Regulation operating costs.
ADJ operating = Estimated operating cost of Regulation adjusted for tax and currency valuation.

Canron Pipe Co. Ltd. has changed name and ownership. It is now Canada Pipe Company Ltd. a wholly owned subsidiary of McWane Inc. located in Birmingham, Alabama. For the purpose of this report Canron financial data has been used.

REFERENCES

Company Annual Financial Reports, 1982 - 1987.

Deloitte, Haskins, and Sells. Metal Casting Industry Economic Profile. Prepared for Policy and Planning Branch, Ontario Ministry of the Environment, April 1988.

Financial Post Information Service Cards, 1988.

Government of Ontario. "Regulation Made Under the Environmental Protection Act, Effluent Monitoring - General", 1988.

M.M. Dillon. Inventory and Critical Review of Laboratory Resources, Toronto. Prepared for the Ontario Ministry of the Environment, 1988.

Ontario Ministry of the Environment. Municipal-Industrial Strategy for Abatement (MISA): A Policy and Program Statement of the Government of Ontario on Controlling Municipal and Industrial Discharges into Surface Waters, June 1986.

Ontario Ministry of the Environment. Economic Information Needs and Assessments for Developing MISA Monitoring and Abatement Requirements, March 1987.

Ontario Ministry of the Environment. Stopping Air Pollution at its Source - CAP - Clean Air Program. Discussion Paper, November 1987.

Ontario Ministry of the Environment. Controlling Industrial Discharges to Sewers, 1988.

Ontario Ministry of the Environment. "Effluent Monitoring Regulation for the Metal Casting Sector", Water Resources Branch, November 1989.

Ontario Ministry of the Environment. "Explanatory Notes to the Effluent Monitoring Regulation for the Metal Casting Sector", November 1989.

Ontario Ministry of the Environment. "The Development Document for the Effluent Monitoring Regulation for the Metal Casting Sector", November 1989.